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BE IT KNOWN that I, Oleg Sokolov  
have invented certain new and useful improvements in

A CELLULAR X-RAY GRID

of which the following is a complete specification:



BACKGROUND OF THE INVENTION

The present invention relates to cellular X-ray grids which are used in medical X-ray technique.

More particularly, it relates to a cellular X-ray grid which can be utilized during investigations conducted with X-rays in medicine as well as in other areas.

X-ray grids are known in which a lattice is composed of light sensitive glass which has slots or cells isolated

0.5  
1/11/93

from one another by specially oriented partitions <sup>which absorb the X-Ray radiation</sup> covered

0.5  
1/11/93

through the whole depth with an X-ray transmitting substance.

Such a cellular X-ray grid is disclosed for example in the Soviet Inventor's Certificate No. 441109. The known grids possess several disadvantages. In the case of the cellular

structure of the grid, with the size of the cell extending parallel to the direction of its movement during the exposure

during exposure the complete erasing of the structure of the

0.5  
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cells on the X-ray <sup>picture</sup> ~~gram~~ is not provided. This can lead to

0.5  
1/11/93

reduction of the informative capacity of the X-ray gram. A

completely throughgoing perforated structure of the monolithic grid which is not reinforced mechanically at its ends and

over its upper and lower surfaces does not provide a

sufficient strength of the grid during bending and impact.

The partitions which are covered with the X-ray non-

transmitting layer over their full depth and which however

do not have this coating at the end, can transmit a certain

1 part of dispersed radiation through the non-protected ends.  
This also can somewhat reduce the informative property of the  
0.5. 11/11/93 X-ray <sup>image</sup>~~gram~~. When the structural material is in the spaces in 0.5. 11/11/93  
the cells or slots, the material absorbs a part of the  
5 information within long wave part of the exposing radiation  
which passes through the grid, since a great percentage of the  
long wave radiation is absorbed. It also reduces the  
informative property of the grid about the pathologies which  
are faintly distinguishable as to their density and sizes.  
10 This is very important for early or preventive diagnosis.

#### SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention  
to provide a cellular X-ray grid which avoids the disad-  
vantages of the prior art.

15 More particularly, it is an object of the present  
invention to provide a cellular X-ray grid which is  
characterized with higher informative property and improved  
operational parameters.

20 In keeping with these objects and with others which  
will become apparent hereinafter, one feature of the present  
invention resides, briefly stated, in a cellular X-ray grid in  
which, in order to provide a complete erasing of the image of  
the cells during its movement over the time of X-ray  
examinations, the cells are formed so that on a plan view not

1 a single side of the cells is parallel to a side of the grid  
which is parallel to its movement, and each side of the cells  
is arranged at an angle to the side parallel to the  
directional movement of the grid, which provides a complete  
5 ~~erasing of the image~~ <sup>eliminating of the shadow images</sup> of the cells on the X-ray ~~gram~~ <sup>image</sup> during  
X-ray process during the movement of the grid.

In accordance with another feature of the present  
invention, the sides of the cells can be arranged relative to  
the above mentioned side of the grid at angles calculated in  
10 accordance with Mattson formulas, as disclosed in Acta  
Radiologica, Suppl. 120 (1955, from page 85 to the end).

In accordance with another feature of the present  
invention in order to increase the strength of the grid  
and prevent its bending along its perimeter or along a  
15 part of its perimeter, a monolithic, solid <sup>frame</sup> lining is arranged  
<sup>(possibly monolithically main</sup> around the body of the grid and has a height corresponding to  
the height of the main body and a width sufficient for  
preventing bending of the grid under the action of loads  
during its use.

20 In accordance with a further feature of the present  
invention, in order to increase the impact strength of the  
grid that is important during its transportation and service  
of the X-ray apparatus including the grid, the upper and lower  
surfaces of the grid are protected by a thin X-ray  
25 transmitting plate which is firmly connected with the ends of

1 the partitions and the <sup>frame</sup> ~~lining~~. The <sup>frame</sup> ~~lining~~, and also the main  
part of the grid when there is <sup>frame</sup> ~~no lining~~, together with the  
ends of the plates form the end parts of the grid, and the  
plates themselves form the planes of the grid.

5 In order to improve X-ray absorbing properties of  
the grid, an X-ray absorbing material covers not only the  
internal surfaces of the partitions of the grid but also the  
end surfaces of the partitions and also the <sup>frame</sup> ~~lining~~. In other  
words the X-ray absorbing material covers all surfaces of the  
10 grid which are exposed to liquid or gas <sup>before protection</sup> ~~and not protected~~ by  
the plates.

Finally, in accordance with a further feature of the  
present invention in order to provide maximum possible  
transmittance for the long wave component of the exposing  
15 X-ray radiation, each cell of the grid is filled either with  
gas (including air) or vacuum.

The novel features which are considered as  
characteristic for the invention are set forth in particular  
in the appended claims. The invention itself, however, both  
20 as to its construction and its method of operation, together  
with additional objects and advantages thereof, will be best  
understood from the following description of specific  
embodiments when read in connection with the accompanying  
drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a cellular X-ray grid in accordance with the present invention;

FIG. 2 is a side section part view of the grid in accordance with one embodiment of the present invention;

FIG. 3 is a side view of the grid in accordance with the present invention in accordance with another embodiment, both FIGS. 2 and 3 showing a part II of FIG. 1; and

FIG. 4 is a section side view of a part I of the inventive grid as shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An X-ray grid in accordance with the present invention has a main part as a plate and identified with reference numeral 1. The main part is composed of photo-sensitive glass and provided with a plurality of cells identified with reference numeral 2. The cells 2 are separated from one another by partitions 3. The size of the cells and the partitions are determined in dependence on the predetermined number of cells/cm<sup>2</sup>.

During the exposure of the X-ray <sup>image</sup>~~gram~~, the grid is movable in a predetermined direction identified with the arrow K-L.

1 As can be seen from FIG. 1, the cells are arranged so that  
none of its sides is parallel to the side of the grid which is  
parallel to the direction of movement of the grid. In  
particular, each side of the cell is located at such an angle  
5 to the side extending parallel to the direction of movement of  
the grid that a complete <sup>eliminating of the shadow images</sup> ~~erasing of the image~~ of the cells on  
the X-ray gram is achieved during the process of X-ray  
exposure with the movement of the grid. The angles of the  
inclination of the sides of the cells with respect to the side  
10 of the grid which is parallel to the direction of movement of  
the grid are determined in correspondence with the formulas of  
Mettson.

*Fig 2*  
6 In accordance with a further feature of the present  
invention, a <sup>frame</sup> ~~lining~~ 4 surrounds the main part of the inventive  
grid. The <sup>frame</sup> ~~lining~~ has a height corresponding to the height of  
15 the main part of the grid and a width selected so as to  
prevent bending of the grid under the action of corresponding  
loads.

*Fig 3*  
20 The partitions 3 and the lining are completely  
covered with an X-ray absorbing layer <sup>63</sup> 5. The layer 5 has a  
thickness which provides complete absorption of dispersed  
radiation which impinges on it. Finally, grates or covers 6  
and 7 are arranged at both sides of the grid and fixedly  
connected with the partitions 3 and the <sup>frame</sup> ~~lining~~ 4. The plates  
25 6 and 7 are transmitting for long wave component of the

1 exposing X-ray radiation and protect the grid impact loads.  
The X-ray absorbing material covers not only the inner  
surfaces of the partitions of the grid but also the end  
surfaces of the partitions and the <sup>frame</sup> lining or in other words  
all surfaces of the main grid portion and the <sup>frame</sup> lining.

5 Each cell of the grid is filled with gas (air) or  
vacuum. FIG. 2 shows a so-called parallel grid in which the  
axes of the cells extend perpendicular to the plane of the  
grid. In contrast, FIG. 3 shows the cells of a so-called  
10 focused grid, in which the axes of the cells are inclined  
relative to the line extending through the focal point of the  
X-ray radiation source and perpendicular to the surface of the  
grid.

15 It will be understood that each of the elements  
described above, or two or more together, may also find a  
useful application in other types of constructions differing  
from the types described above.

20 While the invention has been illustrated and  
described as embodied in a cellular X-ray grid, it is not  
intended to be limited to the details shown, since various  
modifications and structural changes may be made without  
departing in any way from the spirit of the present invention.

25 Without further analysis, the foregoing will so  
fully reveal the gist of the present invention that others  
can, by applying current knowledge, readily adapt it for



1 various applications without omitting features that, from the  
standpoint of prior art, fairly constitute essential  
characteristics of the generic or specific aspects of this  
invention.

5 What is claimed as new and desired to be protected  
by Letters Patent is set forth in the appended claims.